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Thesis

SPACED LEARNING IN WORD ANALYSIS

Submitted by

Alice Collins

(B.S. in Ed., Boston University, 1938)

In partial fulfillment of requirements for the
degree of Master of Education.

1941

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1. The first part of the report is a general
introduction to the subject of the study.
2. The second part is a description of the
methodology used in the study.
3. The third part is a description of the
results of the study.

4. The fourth part is a discussion of the
results of the study.
5. The fifth part is a conclusion of the study.

CHAPTER 1
STATEMENT OF PROBLEM AND RESEARCH

CHAPTER 1

This study was undertaken to determine if the skills of word analysis are retained better under the massing of practices (unspaced learning) or under the distribution of practices (spaced learning) on both immediate and delayed recall.

"Distribution of practice generally makes for economy. Under distribution of practice a fact is learned or a skill acquired, with less work than if the practice were massed."1/

Hunter states, "The experimental findings indicate that, within certain limits, learning is accomplished with less work when practice is distributed than when it is concentrated."2/

Boring, Langfeld, Weld, (et al.) say, "The conclusion is well established that, over a wide range of conditions, some form of positive distribution is a more favorable condition of learning than is zero distribution or massed practice."3/

1/ Lorge, I., "Influence of Regularly Interpolated Time Intervals Upon Subsequent Learning", Contributions to Education, #438, Teachers College, Columbia University, 1930.

2/ Hunter, W., "Experimental Studies of Learning", Chap. XV in C.Murchinson, The Foundations of Experimental Psychology. 1929.

3/ Boring, E., Langfeld, H., Weld, H., et al., Psychology, A Factual Textbook, p. 321. 1935.

CHAPTER I

The first and most important principle of the theory of the origin of the universe is that the universe is eternal and uncreated. It is not the product of any cause, and it has no beginning or end. It is a self-sustaining system, and it is not subject to any external influence. The universe is a single, unified whole, and it is not composed of separate parts. It is a continuous, unbroken chain of events, and it is not subject to any interruption or discontinuity. The universe is a single, unified whole, and it is not composed of separate parts. It is a continuous, unbroken chain of events, and it is not subject to any interruption or discontinuity.

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Dashiell states, "from a great number of such researches (Ebbinghaus, Starch) we may consider it well established that, in learning any kind of habit, economy is found by spacing the practice with time intervals instead of attempting to get it completely formed all at one sitting."1/

"It has been found in general that the spacing or distributing of practice periods over a considerable length of time is more saving in the total time and effort spent in memorizing than in trying to learn all the material at one or a few sittings."2/

However, Boring, (et al.) say that "Relatively short intervals are often more detrimental. Very long ones, particularly those which are longer than a few days, are almost always detrimental."3/

Ebbinghaus in an experimental study which involved the learning of a list of twelve nonsense syllables to the point of one correct reproduction, followed immediately by repetitions, found that twenty-four hours later, only

1/Dashiell, J., Fundamentals of General Psychology, p. 410. 1937.

2/Commins, W., Principles of Educational Psychology, p. 411 1937.

3/Boring, E., Langfeld, H., Weld, H., et al., Psychology, A Factual Textbook, p. 321. 1935.

seven repetitions were required to make one correct reproduction. In another experiment with a different list, the same learner reached approximately the same stage in learning with only thirty-eight repetitions spaced over three days. From these results Ebbinghaus concluded: "With any considerable number of repetitions a suitable distribution of them over a space of time is decidedly more advantageous than the massing of them at a single time."1/

The results of Lyons were of similar import. He learned, among other materials, lists of nonsense syllables by the unspaced (massed) and the one-trial-per-day method to the point of one correct repetition. The time required to learn forty-eight nonsense syllables was fifteen minutes and forty-three minutes, respectively, by spaced practice and unspaced practice; seventy-two syllables required twenty-five minutes and one hundred thirty-eight minutes respectively, by spaced and unspaced practice.2/

Robinson's subjects memorized lists of three-place numbers, each number exposed two seconds. There was no time interval between numbers, but six seconds separated the lists. Ten lists were presented to different groups under

1/ Ebbinghaus, H., Memory, p.123. 1913.

2/ Lyon, D., "The Relation of Length of Material to Time Taken for Learning, and the Optimum Distribution of Time," Part 11, Journal of Educational Psychology, 5:85-91. 1914.

the first of these is the fact that the

second is the fact that the

third is the fact that the

fourth is the fact that the

fifth is the fact that the

sixth is the fact that the

seventh is the fact that the

eight is the fact that the

ninth is the fact that the

tenth is the fact that the

eleventh is the fact that the

twelfth is the fact that the

thirteenth is the fact that the

fourteenth is the fact that the

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twenty-second is the fact that the

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twenty-fifth is the fact that the

four conditions of practice: (1) twelve presentations at one sitting; (2) six presentations at each of two sittings, twenty-four hours apart; (3) six presentations at one sitting; (4) three presentations at each of two sittings, twenty-four hours apart. Recall was five minutes, twenty minutes, and twenty-four hours later. With one exception, the distribution of twelve presentations (2) was superior to massing by the criteria of total number of digits recalled, number correct, and average time required for recall per digit. The recall after the three-three presentations (4) was generally inferior to the recall after six massed presentations.^{1/}

Starch analyzed the results from the following periods of code translation: one hundred twenty minutes of continuous work; forty minutes every other day for six days; twenty minutes once per day for six days; ten minutes twice per day for six days. The poorest record was made in the one hundred twenty minute period, and the best record in the ten minute period.^{2/}

Murphy found that three practice periods per week were far superior in both immediate gains and retention

^{1/}Robinson, E., "The Relative Efficiency of Distributed and Concentrated Study in Memorizing," Journal of Experimental Psychology, 4:327-343. 1921.

^{2/}Starch, D., "Periods of Work in Learning," Journal of Educational Psychology, 3:209-213. 1912.

to daily practice in javelin throwing. Ten successive throws were better than two periods per day of five throws each. In general, all results seemed to indicate fewer practice periods.^{1/}

In Carr's experimental study one group practiced in a maze one trial per day for ten days, and ten trials on the eleventh day. The second group reversed the procedure. The first group made fewer errors than the second group, but the time difference in learning was insignificant.^{2/}

Lorge used zero, one minute, and one day intervals between one-minute practice periods on the stabilimeter. The one day interval was slightly superior to the one-minute interval, and both were superior to the zero interval.^{3/}

Hovland's subjects learned twelve-unit lists of nonsense syllables under the following conditions of practice:

	Inter-list Interval	Each Syllable Exposed	Av. No. Trials Required
1. Massed	6"	2"	14.89
2. Massed	6"	4"	6.78
3. Distributed	2'-6"	2"	11.18
4. Distributed	2'-6"	4"	5.85

^{1/} Murphy, H., "Distribution of Practice Periods in Learning," Journal of Educational Psychology, 7:150-162. 1916.

^{2/} Carr, H., "Distribution of Effort," Psychological Bulletin, 16: 26-28. 1919.

^{3/} Lorge, I., "Influence of Regularly Interpolated Time Intervals Upon Subsequent Learning," Contributions to Education #438, Teachers College, Columbia University, 1930.

... early practice in Jewish children. The successive groups
 were better than the previous one and of like order. In
 general, the child's ability to learn from practice

continued.

In the second experiment, the child was presented with
 a series of trials in which the first trial was
 the easiest one. The second trial was more difficult. The
 third trial was even more difficult than the second one. The
 fourth trial was the most difficult of all.

Later on, the child was presented with a series of trials
 in which the first trial was the most difficult. The
 second trial was easier than the first. The third trial
 was even easier than the second. The fourth trial was the
 easiest of all. The child's ability to learn from practice
 was shown in the fact that the child was able to learn from
 the first trial and was able to learn from the second trial.

Group	First Trial	Second Trial	Third Trial	Fourth Trial
Group A	1.0	2.0	3.0	4.0
Group B	1.0	2.0	3.0	4.0
Group C	1.0	2.0	3.0	4.0
Group D	1.0	2.0	3.0	4.0

... the child's ability to learn from practice is shown in the fact that the child was able to learn from the first trial and was able to learn from the second trial. The child's ability to learn from practice was shown in the fact that the child was able to learn from the first trial and was able to learn from the second trial. The child's ability to learn from practice was shown in the fact that the child was able to learn from the first trial and was able to learn from the second trial.

All results indicated that distributed practice, whether by intervals between lists, by longer exposure per item, or by combining the two methods, is superior to massed practice in regard to the number of trials. The time advantage of (2) and (4) over groups (1) and (3) was insignificant.^{1/}

From his data secured in experiments at college level, Gentry established the following facts: (1) Under massed practice the lowest scores were made. (2) Under distributed practice the highest scores were made. (3) When conditions of practice were the same for two or more groups, the performance curves were almost identical. (4) When the conditions were changed from massed to distributed practice, the accomplishment increased. (5) When the conditions were changed from distributed to massed practice, the accomplishment decreased.^{2/}

Gordon used meaningful material in her study. Four psychology classes heard and recalled the Athenian Oath under these conditions:

	No. of Readings	Type of Drill	Average Score on Recall	
			Immediate	Delayed
Class 1	6	Unspaced	80	37
Class 2	6	Spaced	76	48
Class 3	3	Unspaced	54	26
Class 4	3	Spaced	45	32

^{1/}Hovland, C., "Experimental Studies in Rote Learning Theory III. Distribution of Practice with Varying Speeds of Syllable Presentation," Journal of Experimental Psychology, 23:172-190. 1938.

^{2/}Gentry, J., "Immediate Effects of Interpolated Rest Periods on Learning Performance," Contributions to Education #799, Teachers College, Columbia University, 1940.

The first part of the report deals with the general situation of the country and the progress of the work. It is followed by a detailed account of the various projects and the results obtained. The report concludes with a summary of the work done and the prospects for the future.

The second part of the report deals with the financial aspects of the work. It gives a detailed account of the income and expenditure of the organization and shows how the work has been financed. It also gives a statement of the assets and liabilities of the organization at the end of the year.

The third part of the report deals with the administrative aspects of the work. It gives a detailed account of the organization of the work and the methods of carrying it out. It also gives a statement of the personnel of the organization and the work done by each of them.

Income		Expenditure	
Grants	£ 1000	Salaries	£ 500
Donations	£ 200	Materials	£ 100
Interest	£ 50	Travel	£ 50
Other	£ 100	Other	£ 100
Total	£ 1350	Total	£ 800

The fourth part of the report deals with the results of the work. It gives a detailed account of the progress made in each of the various projects and the results obtained. It also gives a statement of the work done by each of the personnel of the organization.

The best immediate recall was made under massed practice, but the best delayed recall was made under distribution of practice.^{1/}

Ruch's summary of the experimental literature on distribution and massing of practice for humans states that "the following factors have received experimental consideration and are of major importance: first, the general characteristics of the distribution of practice (number and length of periods, intervals between periods, degree of learning considered, etc.); second, the type of material being learned; third, the age of the subjects; fourth, criterion or aim of the learning (immediate or delayed recall, speed, accuracy, the amount of recall, improvement, etc.); fifth, the order of repetitions within a practice period (whole versus part order); sixth, the manner of studying; seventh, the stage of learning (whether the distribution is equally effective at the initial and final stages of learning and in exercise of a well learned habit)."^{2/}

The following experiment is concerned with the fourth factor. The purposes of the study are;

1. To determine if the skills of word analysis are retained better under spaced or unspaced learn-

^{1/}Gordon, K., "Class Results with Spaced and Unspaced Memorizing," Journal of Educational Psychology, 12:92-97. 1921
^{2/}Ruch, T., "Factors Influencing the Relative Economy of Massed and Distributed Practice in Learning," Psychological Review, 35, 1, 19-45.

the first of these is the fact that the
the second is the fact that the
the third is the fact that the

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the twenty-fifth is the fact that the
the twenty-sixth is the fact that the
the twenty-seventh is the fact that the

practices on immediate recall.

2. To determine if the skills of word analysis are retained better under spaced or unspaced practices on delayed recall.

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

RESEARCH REPORT

1963-1964

CHAPTER 11

PLAN AND CONDUCT OF THE EXPERIMENT

THE
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PRESS

CHAPTER 11

This experiment will always be concerned with the achievement after the same kind and number of units of practice of one group--a group that practiced under distribution or spaced learning, and that practiced under massed or unspaced learning.

The specific type of distributed practice used in this study is that form of distribution in which a constant time interval is spaced after each constant unit of practice.

The specific type of massed practice used is that form of massing in which no constant time interval is spaced after each constant unit of practice.

The study was conducted for eight weeks as a class experiment. Thirty pupils of a combined second and third grade in the town of Wellesley, Massachusetts were used as subjects. No attempt was made to differentiate sexes due to the small number of children in the experiment.

From the results of the Kuhlmann Anderson Intelligence Test the following facts were secured:

	<u>C.A.</u>	<u>M.A.</u>	<u>I.Q.</u>
Mean	<u>8.5</u>	<u>8.5</u>	<u>100</u>
Range	<u>6-6 to 11-1</u>	<u>7-6 to 9-9</u>	<u>78 to 125</u>

One hundred phonograms commonly allotted to

1. Introduction

The purpose of this study is to investigate the effects of various factors on the growth of plants. The study was conducted over a period of six months, during which time the plants were grown under different conditions. The results of the study are presented in the following sections.

The first section discusses the methodology used in the study. This includes a description of the plants used, the growth conditions, and the methods used to measure growth. The second section presents the results of the study, showing the growth of the plants under different conditions.

The third section discusses the implications of the results. This includes a comparison of the results with previous studies and a discussion of the factors that may have influenced the growth of the plants. The fourth section concludes the study, summarizing the findings and suggesting areas for further research.

The study found that the growth of the plants was significantly affected by the different conditions. The results suggest that the growth of the plants is influenced by a number of factors, including light, temperature, and water. Further research is needed to determine the exact effects of these factors on plant growth.

The study also found that the growth of the plants was affected by the different conditions. The results suggest that the growth of the plants is influenced by a number of factors, including light, temperature, and water. Further research is needed to determine the exact effects of these factors on plant growth.

first, second, and third grades were chosen for preliminary testing. These phonograms were presented to each child by tachistoscopic flash of one-fifth second duration. From this check the order of difficulty was determined by checking the frequency of correct responses. Pairs of phonograms were equated and selected on this basis for the units of practice under spaced and unspaced learning. All phonograms selected were unknown by 73.33% to 86.67% of the class:

Spaced Learning		Unspaced Learning	
oast-----og	86.67%	age-----aid	86.67%
ile-----eak	83.33%	ock-----ead	83.33%
ot-----onk	80%	ue-----ick	80%
unk-----oss	76.67%	alk-----ig	76.67%
oon-----aw	76.67%	ob-----igh	76.67%
atch-----oil	76.67%	itch-----ore	76.67%
ood-----ill	73.33%	oom-----ent	73.33%
ain-----uck	73.33%	ape-----ack	73.33%

Five units of practice were used for the purposes of this study.^{1/} An explanation of their composition and method of administration is necessary:

1. Combining Visual and Auditory Analysis.

The experimenter wrote on the black-board two words containing the phonograms to be presented--cross, sunk. The children gave other words they thought

^{1/} Durrell, D., "Word Analysis", Improvement of Basic Reading Abilities, Chap. 1X, p. 208-214. 1940.

...the ... of the ...

...the ... of the ...

...the ... of the ...

...the ... of the ...

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...the ... of the ...

rhymed with them, such as toss, boss, gossip, drunk, bunk, punk, etc. These words were written on the blackboard as given. To make the group conscious of the similarity in words a child circled the parts in each word which were alike. Sunk was changed to sank and cross to cress to show that a change in one letter changes the sound. The children were then asked to shut their eyes and try to "see" the word sunk. The word was then written on the blackboard and the question asked, "How many saw the word correctly?" This was tried with several words containing the phonograms until most of the group had no difficulty.

2. Completing Words from Phonograms.

Several unks and osses were written on the blackboard in random order and different children were asked to go to the board and complete words they had thought of.

3. Quick-flash Presentation of Words Studied.

Most of the words given and studied in presentations 1 and 2 were printed on cards and quickly flashed for sight recognition. Questions or statements relevant to the word were given; for example:

At camp we sleep in a	bunk
It grows in the woods.	moss
This word means the same as shiny	glossy

What do we call old things we
sometimes throw away? Junk

4. Identification of Known Words in Paragraphs.

Paragraphs containing the words familiar to the subjects from presentations 1, 2, and 3 were typed, mimeographed, and given to each subject to read. The experimenter heard each child read the paragraph. The words containing the phonograms were identified.

5. Identification of Unknown Words in Paragraphs.

Paragraphs containing the words not specifically taught, but which contained the phonograms presented were typed, mimeographed, and given to each subject to read. The experimenter heard each child read the paragraph and identify the phonogram.

By the spaced or distributed method of learning the units of practice were spaced over eleven days with four, one day intervals and one, three day interval.

By the unspaced or massing method of learning each unit of practice was presented to the subjects in the order explained on five successive days.

The conditions, the units of practice, the hour of presentation, and the time intervals were as shown

in the schedule below:

Date	No.in Class	Condition Spaced	Hour	No.of Unit	Condition Unspaced	Hour	No.of Unit
1/13/41	30	alk,ig	10:45A.M.	(1)	unk, oss	9A.M.	(1)
1/14/41	30	age,aid	10:45A.M.	(1)	unk, oss	9A.M.	(2)
1/15/41	30	alk,ig	10:45A.M.	(2)	unk, oss	9A.M.	(3)
1/16/41	30	age,aid	10:45A.M.	(2)	unk, oss	9A.M.	(4)
1/17/41	30	alk, ig	10:45A.M.	(3)	unk, oss	9A.M.	(5)
1/20/41	30	age,aid	10:45A.M.	(3)	oast,og	9A.M.	(1)
1/21/41	30	alk,ig	10:45A.M.	(4)	oast,og	9A.M.	(2)
1/22/41	30	age, aid	10:45A.M.	(4)	oast,og	9A.M.	(3)
1/23/41	30	alk,ig	10:45A.M.	(5)	oast,og	9A.M.	(4)
1/24/41	30	age,aid	10:45A.M.	(5)	oast,og	9A.M.	(5)
1/27/41	30	ock,ead	9A.M.	(1)	ile,eak	10:45A.M.	(1)
1/28/41	30	oom,ent	9A.M.	(1)	ile,eak	10:45A.M.	(2)
1/29/41	30	ock,ead	9A.M.	(2)	ile,eak	10:45A.M.	(3)
1/30/41	30	oom,ent	9A.M.	(2)	ile,eak	10:45A.M.	(4)
1/31/41	30	ock,ead	9A.M.	(3)	ile,eak	10:45A.M.	(5)
2/3/41	30	oom,ent	9A.M.	(3)	ood,ill	10:45A.M.	(1)
2/4/41	30	ock,ead	9A.M.	(4)	ood,ill	10:45A.M.	(2)
2/5/41	30	oom,ent	9A.M.	(4)	ood,ill	10:45A.M.	(3)
2/6/41	30	ock,ead	9A.M.	(5)	ood,ill	10:45A.M.	(4)
2/7/41	30	oom,ent	9A.M.	(5)	ood,ill	10:45A.M.	(5)
2/10/41	30	ob,igh	10:45A.M.	(1)	oon,aw	9A.M.	(1)
2/11/41	30	ue,ick	10:45A.M.	(1)	oon, aw	9A.M.	(2)
2/12/41	30	ob,igh	10:45A.M.	(2)	oon,aw	9A.M.	(3)
2/13/41	30	ue,ick	10:45A.M.	(2)	oon,aw	9A.M.	(4)
2/14/41	30	ob,igh	10:45A.M.	(3)	oon,aw	9A.M.	(5)
2/17/41	30	ue,ick	10:45A.M.	(3)	ot,onk	9A.M.	(1)
2/18/41	30	ob,igh	10:45A.M.	(4)	ot,onk	9A.M.	(2)
2/19/41	30	ue,ick	10:45A.M.	(4)	ot,onk	9A.M.	(3)
2/20/41	30	ob,igh	10:45A.M.	(5)	ot,onk	9A.M.	(4)
2/21/41	30	ue,ick	10:45A.M.	(5)	ot,onk	9A.M.	(5)
3/3/41	30	itch,ore	9A.M.	(1)	atch,oil	10:45A.M.	(1)
3/4/41	30	ape,ack	9A.M.	(1)	atch,oil	10:45A.M.	(2)
3/5/41	30	itch,ore	9A.M.	(2)	atch,oil	10:45A.M.	(3)
3/6/41	30	ape,ack	9A.M.	(2)	atch,oil	10:45A.M.	(4)
3/7/41	30	itch,ore	9A.M.	(3)	atch,oil	10:45A.M.	(5)

Date	No.in Condition			No.of Condition			No.of
	Class	Spaced	Hour	Unit	Unspaced	Hour	Unit
3/10/41	30	ape,ack	9A.M.	(3)	ain,uck	10:45A.M.	(1)
3/11/41	30	itch,ore	9A.M.	(4)	ain, uck	10:45A.M.	(2)
3/12/41	30	ape,ack	9A.M.	(4)	ain,uck	10:45A.M.	(3)
3/13/41	30	itch,ore	9A.M.	(5)	ain,uck	10:45A.M.	(4)
3/14/41	30	ape,ack	9A.M.	(5)	ain,uck	10:45A.M.	(5)

The spaced and unspaced conditions of practice were designed to be as similar as possible in all respects except the time intervals. Motivation did not seem to be an important factor in this study. Utmost effort was taken to eliminate any element of fatigue or tension that might lower accomplishment or interfere with the learning process.

"In testing whether a child has acquired an adequate knowledge of any word element, it is essential to discover whether or not he can use it in solving a word."^{1/}

To determine if the skills of word analysis are retained better by spaced or unspaced learning on immediate recall, six words for each phonogram presented, were tested at the end of the five units of practice. This test consisted of a tachistoscopic flash of one-fifth, one half, and three second's duration. If a word was not given promptly on the three second flash it was counted as an error. The utmost care was exercised in equating the test words in respect to their unfamiliarity to the subjects.

^{1/} Durrell, D., "Word Analysis", Improvement of Basic Reading Abilities, Chap. IX, p.198-199.1940.

To determine if the skills of word analysis are retained better by spaced or unspaced learning on delayed recall the same words tested for immediate recall were re-tested after a four week interval. The same procedure was used in checking delayed recall that was used for immediate.

In order to compare the spaced method of learning with the unspaced method of learning for the purposes of this study the mean, the standard error of the mean, the difference between the means, the standard error of the difference, and the ratio were computed for the tests of both immediate and delayed recall.

CHAPTER 111
STATISTICAL ANALYSIS
OF DATA

CHAPTER 111

The following table presents the number of correct responses on the tachistoscopic test for immediate recall under the spaced learning condition.

Table 1

No. of Case	one fifth second	one half second or less	three seconds or less
1.	95	96	96
2.	30	37	57
3.	49	65	81
4.	70	86	95
5.	55	74	86
6.	93	94	95
7.	96	96	96
8.	49	62	78
9.	75	87	94
10.	50	63	79
11.	79	91	95
12.	91	96	96
13.	94	96	96
14.	68	79	93
15.	94	96	96
16.	91	96	96
17.	78	90	91
18.	75	87	94
19.	42	49	67
20.	90	96	96
21.	91	94	95
22.	93	96	96
23.	94	96	96
24.	96	96	96
25.	92	95	96
26.	90	95	96
27.	52	69	81
28.	94	96	96
29.	92	95	96
30.	86	96	96

The following table presents the number of correct responses on the tachistoscopic test for immediate recall under the unspaced learning condition.

Table 11

No. of Case	one fifth second	one half second or less	three seconds or less
1.	92	94	96
2.	21	23	41
3.	41	48	66
4.	71	86	95
5.	49	64	84
6.	90	93	96
7.	93	95	96
8.	31	36	59
9.	77	86	91
10.	29	33	54
11.	71	79	90
12.	91	93	96
13.	90	94	96
14.	63	74	86
15.	91	94	95
16.	88	94	96
17.	74	81	89
18.	62	72	88
19.	29	34	45
20.	84	91	93
21.	72	80	95
22.	90	93	95
23.	90	94	94
24.	94	95	96
25.	77	91	95
26.	90	96	96
27.	53	64	79
28.	93	96	96
29.	85	92	95
30.	79	92	96

Distribution of the Scores of the Thirty Children on the Tachistoscopic Test of One-fifth Second Duration for Immediate Recall under Spaced and Unspaced Learning.

Table 111

Spaced Learning		Unspaced Learning	
<u>Score</u>	<u>Frequency</u>	<u>Score</u>	<u>Frequency</u>
95-100	3	90-94	11
90-94	13	85-89	2
85-89	1	80-84	1
80-84	0	75-79	3
75-79	4	70-74	4
70-74	1	65-69	0
65-69	1	60-64	2
60-64	0	55-59	0
55-59	1	50-54	1
50-54	2	45-49	1
45-49	2	40-44	1
40-44	1	35-39	0
35-39	0	30-34	1
30-34	1	25-29	2
	<hr/>	20-24	1
	N. 30		<hr/>
			N. 30
Mean	78.85	Mean	72.5
S.D.	19.1	S.D.	21.05

A further analysis of the distribution of scores found in the graph which follows this.

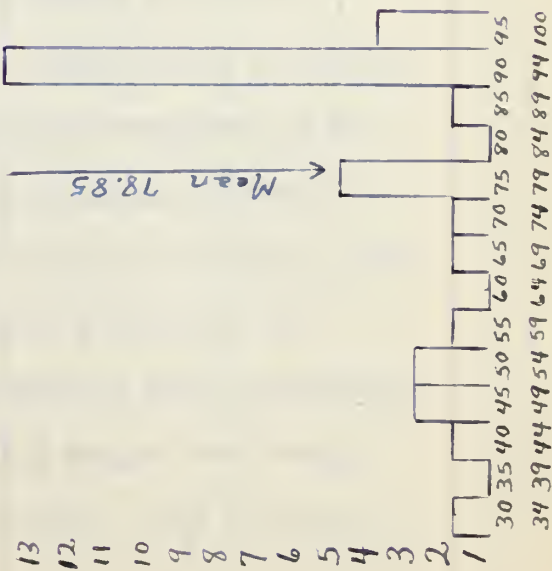
The mean falls at 78.85 for the tachistoscopic test of one-fifth second duration on the spaced learning method. Sigma, or the standard deviation equalled 19.1. The standard deviation was large due to the size and number of extreme variations.

The mean falls at 72.5 for the tachistoscopic test of one-fifth second duration under the unspaced learning

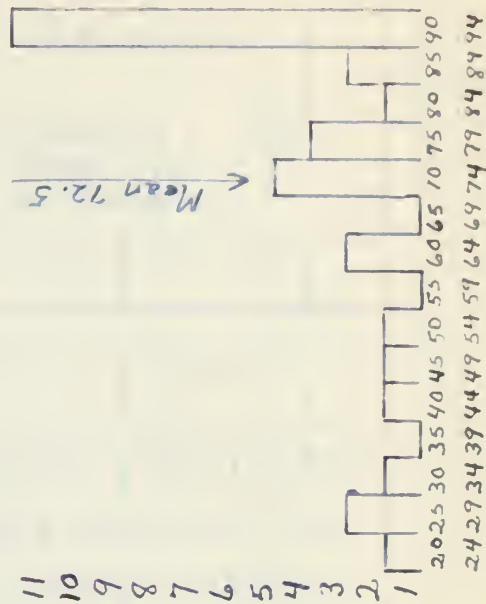
Graph 1.

Distribution of Scores on Tachistoscopic
Test of One-fifth Second Duration for
Immediate Recall under Spaced and
Unspaced learning.

Spaced Learning



Unspaced learning



method. Sigma, or the standard deviation equalled 21.05.

Type of Practice	Mean	Table IV			
		Standard Error of Mean	Difference	Standard Error of Difference	Ratio
Spaced	78.85	3.49	6.35	5.19	1.22
Unspaced	72.5	3.84			

The standard error of the mean on the tachistoscopic test of one-fifth second duration for immediate recall was 3.49 under spaced learning. This indicates that if similar measurements were made of such groups approximately two thirds (68.26%) of all the means so found would be within 3.49 of the observed mean 78.85. In other words, the chances are two to one that the true mean lies within 3.49 units of 78.85, or between 75.36 and 82.34.

The standard error of the mean was 3.48 under unspaced learning. The chances are two to one that the true mean lies within 3.48 units of 72.5, or between 68.66 and 76.34.

The scores for the group under spaced and unspaced learning were as follows: The thirty children averaged 78.85 with a sigma of 19.1 under spaced learning; the same group averaged 72.5 with a sigma of 21.05 under spaced learning. The difference between the two means, 78.85-72.5 was 6.35. To determine its significance the standard error of the difference was computed. The standard error of the difference was found to be 5.19. The chances are two to one (68.26%) that the true

difference will lie within 5.19 units from the observed difference 6.35. In other words, the chances are two to one that similar groups under spaced learning will exceed groups under unspaced learning on this test by an amount between 1.16 and 11.54.

The ratio between the difference and its standard error was computed. This equalled 1.22 and shows that the zero point is $1.22 \epsilon_D$ units below the observed difference. In other words, we find that the chances are about 7.7 to 1 that the true difference would not be $1.22 \epsilon_D$ units below the observed difference. We are therefore justified in saying that, in so far as the test is valid and the group representative, we are not certain that the skills of word analysis are retained better on immediate recall under spaced learning.

Distribution of the Scores of the Thirty Children on the Tachistoscopic Test of One-half Second Duration or less for Immediate Recall under Spaced and Unspaced Learning.

Table V

Spaced Learning		Unspaced Learning	
<u>Score</u>	<u>Frequency</u>	<u>Score</u>	<u>Frequency</u>
95-99	15	95-99	4
90-94	4	90-94	12
85-89	3	85-89	2
80-84	0	80-84	2
75-79	1	75-79	1
70-74	1	70-74	2
65-69	2	65-69	0
60-64	2	60-64	2
55-59	0	55-59	0
50-54	0	50-54	0
45-49	1	45-49	1
40-44	0	40-44	0
35-39	1	35-39	1
		30-34	2
		25-29	0
		20-24	1
	<hr/> N. 30		<hr/> N. 30
Mean	86.35	Mean	78.35
S.D.	16.35	S.D.	21.55

The mean falls at 86.35 for the tachistoscopic test of one-half second duration or less on immediate recall under the spaced learning method. Sigma, or standard deviation equalled 16.35.

The mean falls at 78.35 on the same test but under the unspaced learning method. Sigma, or standard deviation equalled 21.55.

Table VI

Type of Practice	Mean	Standard Error of Mean	Difference	Standard Error of Difference	Ratio
Spaced	86.35	2.98	8	4.93	1.62
Unspaced	78.35	3.93			

The standard error of the mean on the tachistiscopic test of one-half second duration or less for immediate recall under spaced learning was 2.98. The chances are two to one that the true mean lies within 2.98 units of 86.35, or between 83.37 and 89.33.

The standard error of the mean on the tachistiscopic test of one-half second duration or less for immediate recall under unspaced learning was 3.93. This indicates that the chances are two to one that the true mean lies within 3.93 units of 78.35, or between 74.42 and 82.28.

The difference between the two means, 86.35-78.35 was 8. To determine its significance the standard error of the difference was computed. This equalled 4.93. The chances are two to one (68.26%) that the true mean difference will lie within 4.93 units from the observed difference 8. In other words, the chances are two to one that similar groups under spaced learning will exceed groups under unspaced learning on this test by an amount between 3.07 and 12.93.

The ratio between the difference and its standard error was 1.62. The chances are about 17.2 to 1 that the true difference would not be $1.62 \epsilon_D$ units below the observed difference. We are therefore justified in saying that, in so far as the test is valid and the group representative, we are not certain that the skills of word analysis are retained better on immediate recall under spaced learning.

Distribution of the Scores of the Thirty Children on the Tachistoscopic Test of Three Second's Duration or less for Immediate Recall under Spaced and Unspaced Learning.

Table VII

Spaced Learning		Unspaced Learning	
<u>Score</u>	<u>Frequency</u>	<u>Score</u>	<u>Frequency</u>
96-98	15	95-99	16
93-95	7	90-94	4
90-92	1	85-89	3
87-89	0	80-84	1
84-86	1	75-79	1
81-83	2	70-74	0
78-80	2	65-69	1
75-77	0	60-64	0
72-74	0	55-59	1
69-71	0	50-54	1
66-68	1	45-49	1
63-65	0	40-44	1
60-62	0		<u>1</u>
57-59	<u>1</u>		N. 30
	N. 30		
Mean	91.71	Mean	86.35
S.D.	9.57	S.D.	16.3

The mean falls at 91.71 for the tachistoscopic test of three second's duration or less on immediate recall under the spaced learning method. Sigma, or the standard deviation equalled 9.57.

The mean falls at 86.35 on the same test but under the unspaced learning method. Sigma, or the standard deviation equalled 16.3.

The first part of the paper is devoted to a review of the literature on the topic of the effect of the environment on the development of the individual. The second part is devoted to a study of the effect of the environment on the development of the individual.

Table 1

Group 1		Group 2	
Age	Height	Age	Height
10	140	10	140
11	145	11	145
12	150	12	150
13	155	13	155
14	160	14	160
15	165	15	165
16	170	16	170
17	175	17	175
18	180	18	180
19	185	19	185
20	190	20	190

The results of the study show that the effect of the environment on the development of the individual is significant. The first part of the paper is devoted to a review of the literature on the topic of the effect of the environment on the development of the individual. The second part is devoted to a study of the effect of the environment on the development of the individual.

Table VIII

Type of Practice	Mean	Standard Error of Mean	Difference	Standard Error of Difference	Ratio
Spaced	91.71	1.74	5.36	3.44	1.55
Unspaced	86.35	2.97			

The standard error of the mean on the tachistiscopic test of three second's duration or less for immediate recall under spaced learning was 1.74. The chances are two to one that the true mean lies within 1.74 units of 91.71, or between 89.97 and 93.45.

The standard error of the mean on the tachistiscopic test of three second's duration or less for immediate recall under unspaced learning was 2.97. This indicates that the chances are two to one that the true mean lies within 2.97 units of 86.35, or between 83.38 and 89.32.

The difference between the two means, 91.71-86.35 was 5.36. To determine its significance the standard error of the difference was computed. This equalled 3.44. The chances are two to one that the true mean difference will lie within 3.44 units from the observed difference 5.36. In other words, the chances are two to one that similar groups under spaced learning will exceed groups under unspaced learning on this test by an amount between 1.92 and 8.8.

1941-1942

Year	1941	1942	1943	1944	1945	1946
...

...

...

...

...

The ratio between the difference and its standard error was 1.55. The chances are about 15.5 to 1 that the true difference would not be $1.55 \varepsilon_D$ units below the observed difference. We are therefore justified in saying that, in so far as the test is valid and the group representative, we are not certain that the skills of word analysis are retained better under spaced learning.

1. The Commission on the Environment, Energy and
Climate Change has been established to advise the Government
on all matters relating to the environment, energy and
climate change. The Commission will be a permanent
body and will report to the Government on a regular
basis. The Commission will be chaired by a senior
member of the Government and will include representatives
from all relevant departments and agencies.

The following table presents the number of correct responses on the tachistoscopic test for delayed recall under the spaced learning condition.

Table IX

No. of Case	one-fifth second	one-half second or lesss	three seconds or less
1.	95	96	96
2.	34	48	63
3.	65	75	86
4.	73	91	93
5.	78	89	93
6.	94	96	96
7.	96	96	96
8.	67	77	90
9.	84	91	94
10.	65	80	89
11.	87	94	94
12.	94	96	96
13.	94	96	96
14.	63	77	88
15.	96	96	96
16.	94	96	96
17.	82	91	95
18.	83	86	92
19.	35	50	64
20.	90	95	96
21.	88	93	96
22.	94	96	96
23.	92	96	96
24.	95	96	96
25.	92	96	96
26.	94	96	96
27.	63	75	85
28.	95	96	96
29.	94	96	96
30.	88	96	96

THE UNIVERSITY OF CHICAGO
DIVISION OF THE PHYSICAL SCIENCES
DEPARTMENT OF CHEMISTRY

1950

RECEIVED AT THE UNIVERSITY OF CHICAGO
LIBRARY

1. <i>Chemical Abstracts</i>	2. <i>Journal of the American Chemical Society</i>	3. <i>Journal of the Royal Chemical Society</i>	4. <i>Journal of the Chemical Physics</i>
5. <i>Journal of the Physical Chemistry</i>	6. <i>Journal of the American Chemical Society</i>	7. <i>Journal of the Royal Chemical Society</i>	8. <i>Journal of the Chemical Physics</i>
9. <i>Journal of the Physical Chemistry</i>	10. <i>Journal of the American Chemical Society</i>	11. <i>Journal of the Royal Chemical Society</i>	12. <i>Journal of the Chemical Physics</i>
13. <i>Journal of the Physical Chemistry</i>	14. <i>Journal of the American Chemical Society</i>	15. <i>Journal of the Royal Chemical Society</i>	16. <i>Journal of the Chemical Physics</i>
17. <i>Journal of the Physical Chemistry</i>	18. <i>Journal of the American Chemical Society</i>	19. <i>Journal of the Royal Chemical Society</i>	20. <i>Journal of the Chemical Physics</i>
21. <i>Journal of the Physical Chemistry</i>	22. <i>Journal of the American Chemical Society</i>	23. <i>Journal of the Royal Chemical Society</i>	24. <i>Journal of the Chemical Physics</i>
25. <i>Journal of the Physical Chemistry</i>	26. <i>Journal of the American Chemical Society</i>	27. <i>Journal of the Royal Chemical Society</i>	28. <i>Journal of the Chemical Physics</i>
29. <i>Journal of the Physical Chemistry</i>	30. <i>Journal of the American Chemical Society</i>	31. <i>Journal of the Royal Chemical Society</i>	32. <i>Journal of the Chemical Physics</i>
33. <i>Journal of the Physical Chemistry</i>	34. <i>Journal of the American Chemical Society</i>	35. <i>Journal of the Royal Chemical Society</i>	36. <i>Journal of the Chemical Physics</i>
37. <i>Journal of the Physical Chemistry</i>	38. <i>Journal of the American Chemical Society</i>	39. <i>Journal of the Royal Chemical Society</i>	40. <i>Journal of the Chemical Physics</i>
41. <i>Journal of the Physical Chemistry</i>	42. <i>Journal of the American Chemical Society</i>	43. <i>Journal of the Royal Chemical Society</i>	44. <i>Journal of the Chemical Physics</i>
45. <i>Journal of the Physical Chemistry</i>	46. <i>Journal of the American Chemical Society</i>	47. <i>Journal of the Royal Chemical Society</i>	48. <i>Journal of the Chemical Physics</i>
49. <i>Journal of the Physical Chemistry</i>	50. <i>Journal of the American Chemical Society</i>	51. <i>Journal of the Royal Chemical Society</i>	52. <i>Journal of the Chemical Physics</i>
53. <i>Journal of the Physical Chemistry</i>	54. <i>Journal of the American Chemical Society</i>	55. <i>Journal of the Royal Chemical Society</i>	56. <i>Journal of the Chemical Physics</i>
57. <i>Journal of the Physical Chemistry</i>	58. <i>Journal of the American Chemical Society</i>	59. <i>Journal of the Royal Chemical Society</i>	60. <i>Journal of the Chemical Physics</i>
61. <i>Journal of the Physical Chemistry</i>	62. <i>Journal of the American Chemical Society</i>	63. <i>Journal of the Royal Chemical Society</i>	64. <i>Journal of the Chemical Physics</i>
65. <i>Journal of the Physical Chemistry</i>	66. <i>Journal of the American Chemical Society</i>	67. <i>Journal of the Royal Chemical Society</i>	68. <i>Journal of the Chemical Physics</i>
69. <i>Journal of the Physical Chemistry</i>	70. <i>Journal of the American Chemical Society</i>	71. <i>Journal of the Royal Chemical Society</i>	72. <i>Journal of the Chemical Physics</i>
73. <i>Journal of the Physical Chemistry</i>	74. <i>Journal of the American Chemical Society</i>	75. <i>Journal of the Royal Chemical Society</i>	76. <i>Journal of the Chemical Physics</i>
77. <i>Journal of the Physical Chemistry</i>	78. <i>Journal of the American Chemical Society</i>	79. <i>Journal of the Royal Chemical Society</i>	80. <i>Journal of the Chemical Physics</i>
81. <i>Journal of the Physical Chemistry</i>	82. <i>Journal of the American Chemical Society</i>	83. <i>Journal of the Royal Chemical Society</i>	84. <i>Journal of the Chemical Physics</i>
85. <i>Journal of the Physical Chemistry</i>	86. <i>Journal of the American Chemical Society</i>	87. <i>Journal of the Royal Chemical Society</i>	88. <i>Journal of the Chemical Physics</i>
89. <i>Journal of the Physical Chemistry</i>	90. <i>Journal of the American Chemical Society</i>	91. <i>Journal of the Royal Chemical Society</i>	92. <i>Journal of the Chemical Physics</i>
93. <i>Journal of the Physical Chemistry</i>	94. <i>Journal of the American Chemical Society</i>	95. <i>Journal of the Royal Chemical Society</i>	96. <i>Journal of the Chemical Physics</i>
97. <i>Journal of the Physical Chemistry</i>	98. <i>Journal of the American Chemical Society</i>	99. <i>Journal of the Royal Chemical Society</i>	100. <i>Journal of the Chemical Physics</i>

The following table presents the number of correct responses on the tachistoscopic test for delayed recall under the unspaced learning method.

Table X

No. of Case	one-fifth second or less	one-half second or less	three seconds or less
1.	88	96	96
2.	17	24	38
3.	33	46	57
4.	54	77	83
5.	62	73	86
6.	92	96	96
7.	91	94	95
8.	55	69	77
9.	83	88	93
10.	42	59	78
11.	67	82	92
12.	85	92	96
13.	88	92	96
14.	55	73	83
15.	93	94	95
16.	90	93	96
17.	66	77	86
18.	71	88	94
19.	18	33	47
20.	83	93	95
21.	82	87	92
22.	87	92	96
23.	86	94	96
24.	92	95	96
25.	84	88	92
26.	92	93	96
27.	56	63	77
28.	92	94	96
29.	86	92	96
30.	85	94	95

The following are the names of the persons who
 have been appointed to the various positions
 of the Board of Directors of the Company.

DIRECTORS

Name	Address	City	State	Term	Notes
J. H. Smith	123 Main St.	New York	N.Y.	1910-1912	President
W. B. Jones	456 Broadway	New York	N.Y.	1912-1914	Vice President
C. D. Brown	789 Third Ave.	New York	N.Y.	1914-1916	Director
E. F. White	101 West 12th St.	New York	N.Y.	1916-1918	Director
G. H. Black	234 Fifth Ave.	New York	N.Y.	1918-1920	Director
I. J. Green	567 Sixth Ave.	New York	N.Y.	1920-1922	Director
K. L. Hall	890 Seventh Ave.	New York	N.Y.	1922-1924	Director
L. M. King	1123 Eighth Ave.	New York	N.Y.	1924-1926	Director
M. N. Lee	1456 Ninth Ave.	New York	N.Y.	1926-1928	Director
O. P. Scott	1789 Tenth Ave.	New York	N.Y.	1928-1930	Director
P. Q. Adams	2112 Eleventh Ave.	New York	N.Y.	1930-1932	Director
R. S. Baker	2445 Twelfth Ave.	New York	N.Y.	1932-1934	Director
T. U. Clark	2778 Thirteenth Ave.	New York	N.Y.	1934-1936	Director
V. W. Evans	3111 Fourteenth Ave.	New York	N.Y.	1936-1938	Director
X. Y. Foster	3444 Fifteenth Ave.	New York	N.Y.	1938-1940	Director
Y. Z. Gibson	3777 Sixteenth Ave.	New York	N.Y.	1940-1942	Director
Z. A. Harris	4110 Seventeenth Ave.	New York	N.Y.	1942-1944	Director

Distribution of the Scores of the Thirty Children on the Tachistoscopic Test of One-fifth Second Duration for Delayed Recall under Spaced and Unspaced Learning.

Table XI

Spaced Learning		Unspaced Learning	
<u>Score</u>	<u>Frequency</u>	<u>Score</u>	<u>Frequency</u>
95-99	5	90-94	7
90-94	10	85-89	7
85-89	3	80-84	4
80-84	3	75-79	0
75-79	1	70-74	1
70-74	1	65-69	2
65-69	3	60-64	1
60-64	2	55-59	3
55-59	0	50-54	1
50-54	0	45-49	0
45-49	0	40-44	1
40-44	0	35-39	0
35-39	1	30-34	1
30-34	1	25-29	0
	<hr/>	20-24	0
N. 30		15-19	2
			<hr/>
			N.30
Mean	82.35	Mean	73.15
S.D.	16.65	S.D.	22

A further analysis of the distribution of scores is found in the graph which follows this.

The mean falls at 82.35 for the tachistoscopic test of one-fifth second duration on delayed recall under the spaced learning method. Sigma, or standard deviation equalled 16.65.

The mean falls for the same test but under the unspaced learning method at 73.15. Sigma, or standard deviation equalled 22.

and in accordance with the law of conservation of energy, the energy of the system must be constant. The energy of the system is the sum of the kinetic energy and the potential energy. The kinetic energy is the energy of motion, and the potential energy is the energy of position. The total energy of the system is the sum of the kinetic energy and the potential energy. The total energy of the system is constant.

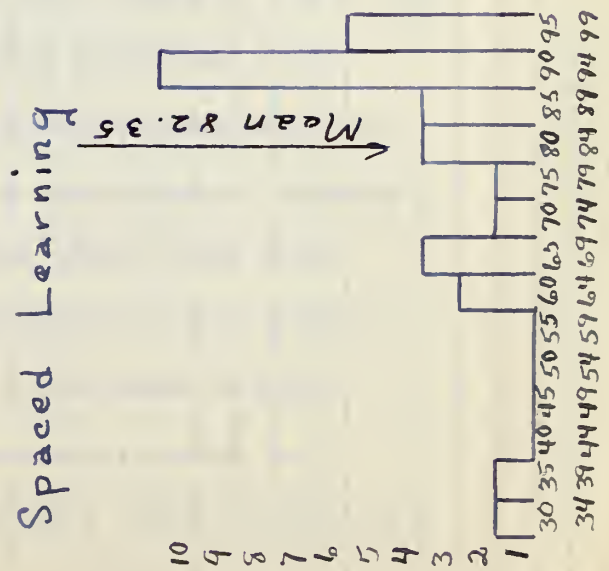
TABLE I

Initial Energy		Final Energy	
Position	Velocity	Position	Velocity
100	0	100	0
90	3.13	90	3.13
80	6.26	80	6.26
70	9.39	70	9.39
60	12.52	60	12.52
50	15.65	50	15.65
40	18.78	40	18.78
30	21.91	30	21.91
20	25.04	20	25.04
10	28.17	10	28.17
0	31.30	0	31.30

The energy of the system is constant. The energy of the system is the sum of the kinetic energy and the potential energy. The kinetic energy is the energy of motion, and the potential energy is the energy of position. The total energy of the system is the sum of the kinetic energy and the potential energy. The total energy of the system is constant.

Graph II

Distribution of Scores on Tachistoscopic
Test of One-Fifth Second Duration for
Delayed Recall under Spaced and Un-
spaced Learning.



Unspaced Learning

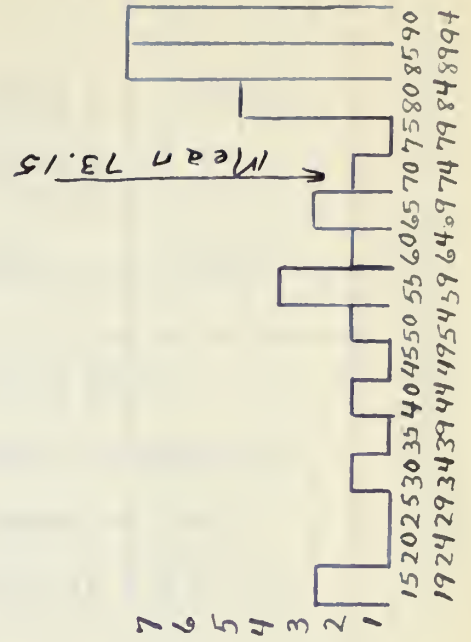


Table XII

Type of Practice	Mean	Standard Error of Mean	Difference	Standard Error of Difference	Ratio
Spaced	82.35	4.01	9.2	5.03	1.83
Unspaced	73.15	3.04			

The standard error of the mean on the tachistoscopic test of one-fifth second duration for delayed recall under spaced learning was 4.01. The chances are two to one that the true mean lies within 4.01 units of 82.35, or between 78.34 and 86.36.

The standard error of the mean for the same test but under the unspaced learning method was 3.04. This indicates that the chances are two to one that the true mean lies within 3.04 units of 73.15, or between 70.11 and 76.19.

The difference between the two means 82.35-73.15 was 9.2. To determine its significance the standard error of the difference was computed. This equalled 5.03. The chances are two to one that the true mean difference will lie within 5.03 units from the observed difference 9.2. In other words, the chances are two to one that similar groups under spaced learning will exceed groups under unspaced learning on this test by an amount between 4.17 and 14.23.

The ratio between the difference and its standard error was 1.83. The chances are about 26.8 to 1 that the true difference would not be $1.83 \epsilon_D$ units below the

CHAPTER I

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observed difference. We are therefore justified in saying that, in so far as the test is valid and the group representative, we are not certain that the skills of word analysis are retained better under spaced learning.

The first of the two main parts of the book is devoted to the study of the properties of the function $f(x)$ which is defined by the equation $f(x) = \sum_{n=0}^{\infty} a_n x^n$ where a_n are the coefficients of the power series. The second part is devoted to the study of the properties of the function $f(x)$ which is defined by the equation $f(x) = \sum_{n=0}^{\infty} a_n x^n$ where a_n are the coefficients of the power series.

Distribution of the Scores of the Thirty Children on the Tachistiscopic Test of One-half Second Duration or less for Delayed Recall under Spaced and Unspaced learning.

Table XIII

Spaced Learning		Unspaced Learning	
<u>Score</u>	<u>Frequency</u>	<u>Score</u>	<u>Frequency</u>
95-99	16	95-99	3
90-94	5	90-94	12
85-89	2	85-89	4
80-84	1	80-84	1
75-79	4	75-79	2
70-74	0	70-74	2
65-69	0	65-69	1
60-64	0	60-64	1
55-59	0	55-59	1
50-54	1	50-54	0
45-49	1	45-49	1
	<hr/> N.30	40-44	0
		35-39	0
		30-34	1
		25-29	0
		20-24	1
			<hr/> N. 30
Mean	89.65	Mean	80.85
S.D.	12.7	S.D.	18.9

The mean falls at 89.65 for the tachistiscopic test of one-half second duration or less under the spaced learning method. Sigma, or the standard deviation was 12.7

The mean falls at 80.85 for the same test but under the unspaced learning method. Sigma, or the standard deviation equalled 18.9.

Type of Practice	Mean	Standard Error of Mean	Table XIV		Ratio
			Difference	Standard Error of Difference	
Spaced	89.65	2.32	8.8	4.16	2.22
Unspaced	80.85	3.45			

The standard error of the mean on the tachistoscopic test of one-half second duration or less for delayed recall under the spaced learning method was 2.32. The chances are two to one that the true mean lies within 2.32 units of 89.65, or between 87.33 and 91.97.

The standard error of the mean on the same test but under the unspaced learning method was 3.45. The chances are two to one that the true mean lies within 3.45 units of 80.85, or between 77.40 and 84.30.

The difference between the two means 89.65-80.85 was 8.8. To determine its significance the standard error was computed. This equalled 4.16. The chances are two to one that the true difference will lie within 4.16 units from the observed difference 8.8. In other words, the chances are two to one that similar groups under spaced learning will exceed similar groups under unspaced learning by an amount between 4.64 and 12.96.

The ratio between the difference and its standard error was 2.22. The chances are about 70.9 to 1 that the true difference would not be $2.22 \frac{e}{D}$ units below the

THE HISTORY OF THE UNITED STATES

The history of the United States is a long and complex one, spanning over two centuries. It begins with the first European settlers in the early 17th century, who established colonies along the eastern coast. These colonies were founded for various reasons, including religious freedom, economic opportunity, and political freedom. Over time, these colonies grew and developed, and eventually, they declared their independence from Britain in 1776. The American Revolution was a pivotal moment in the nation's history, leading to the creation of the United States as a sovereign nation. In the years following the Revolution, the country faced numerous challenges, including the struggle for slavery, the War of 1812, and the Civil War. The Civil War was particularly significant, as it resulted in the abolition of slavery and the preservation of the Union. The Reconstruction period that followed was a time of great change and struggle, as the country sought to rebuild and reunite. The late 19th and early 20th centuries saw rapid industrialization and the growth of the middle class, but also the rise of imperialism and the Spanish-American War. The 1920s and 1930s were marked by the Great Depression and the rise of the New Deal. The mid-20th century was dominated by the Cold War, which saw the United States and the Soviet Union engaged in a global struggle for power. The Vietnam War was a major conflict during this period, and the civil rights movement was a significant social and political movement. The late 20th and early 21st centuries have seen the end of the Cold War, the rise of the Internet and globalization, and the challenges of terrorism and climate change. The United States continues to be a major power in the world, and its history remains a subject of great interest and study.

observed difference. We are therefore justified in saying that, in so far as the test is valid and the group representative, we are not certain that the skills of word analysis are retained better under spaced learning.

...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...

Distribution of the Scores of the Thirty Children on the Tachistiscopic Test of Three Second's Duration or less for Delayed Recall under Spaced and Unspaced Learning.

Table XV

Spaced Learning		Unspaced Learning	
<u>Score</u>	<u>Frequency</u>	<u>Score</u>	<u>Frequency</u>
96-98	17	95-99	15
93-95	5	90-94	5
90-92	2	85-89	2
87-89	2	80-84	2
84-86	2	75-79	3
81-83	0	70-74	0
78-80	0	65-69	0
75-77	0	60-64	0
72-74	0	55-59	1
69-71	0	50-54	0
66-68	0	45-49	1
63-65	2	40-44	0
	<hr/> N. 30	35-39	1
			<hr/> N. 30
Mean	93	Mean	88
S. D.	1.98	S. D.	15.25

The mean falls at 93 for the tachistiscopic test of three second's duration or less on the delayed recall under the spaced learning method. Sigma, or the standard deviation equalled 16.65.

The mean falls for the same test but under the unspaced learning method at 88. Sigma, or standard deviation equalled 15.25.

Distribution of the scores of the thirty children on the
Psychographic Test of Three Second's Duration or less for
Delayed Recall under Speed and Accuracy conditions.

Table IV

Speed Accuracy		Speed Accuracy	
Score	Frequency	Score	Frequency
0-10	1	0-10	1
10-20	1	10-20	1
20-30	1	20-30	1
30-40	1	30-40	1
40-50	1	40-50	1
50-60	1	50-60	1
60-70	1	60-70	1
70-80	1	70-80	1
80-90	1	80-90	1
90-100	1	90-100	1
100-110	1	100-110	1
110-120	1	110-120	1
120-130	1	120-130	1
130-140	1	130-140	1
140-150	1	140-150	1
150-160	1	150-160	1
160-170	1	160-170	1
170-180	1	170-180	1
180-190	1	180-190	1
190-200	1	190-200	1
200-210	1	200-210	1
210-220	1	210-220	1
220-230	1	220-230	1
230-240	1	230-240	1
240-250	1	240-250	1
250-260	1	250-260	1
260-270	1	260-270	1
270-280	1	270-280	1
280-290	1	280-290	1
290-300	1	290-300	1
300-310	1	300-310	1
310-320	1	310-320	1
320-330	1	320-330	1
330-340	1	330-340	1
340-350	1	340-350	1
350-360	1	350-360	1
360-370	1	360-370	1
370-380	1	370-380	1
380-390	1	380-390	1
390-400	1	390-400	1
400-410	1	400-410	1
410-420	1	410-420	1
420-430	1	420-430	1
430-440	1	430-440	1
440-450	1	440-450	1
450-460	1	450-460	1
460-470	1	460-470	1
470-480	1	470-480	1
480-490	1	480-490	1
490-500	1	490-500	1
500-510	1	500-510	1
510-520	1	510-520	1
520-530	1	520-530	1
530-540	1	530-540	1
540-550	1	540-550	1
550-560	1	550-560	1
560-570	1	560-570	1
570-580	1	570-580	1
580-590	1	580-590	1
590-600	1	590-600	1
600-610	1	600-610	1
610-620	1	610-620	1
620-630	1	620-630	1
630-640	1	630-640	1
640-650	1	640-650	1
650-660	1	650-660	1
660-670	1	660-670	1
670-680	1	670-680	1
680-690	1	680-690	1
690-700	1	690-700	1
700-710	1	700-710	1
710-720	1	710-720	1
720-730	1	720-730	1
730-740	1	730-740	1
740-750	1	740-750	1
750-760	1	750-760	1
760-770	1	760-770	1
770-780	1	770-780	1
780-790	1	780-790	1
790-800	1	790-800	1
800-810	1	800-810	1
810-820	1	810-820	1
820-830	1	820-830	1
830-840	1	830-840	1
840-850	1	840-850	1
850-860	1	850-860	1
860-870	1	860-870	1
870-880	1	870-880	1
880-890	1	880-890	1
890-900	1	890-900	1
900-910	1	900-910	1
910-920	1	910-920	1
920-930	1	920-930	1
930-940	1	930-940	1
940-950	1	940-950	1
950-960	1	950-960	1
960-970	1	960-970	1
970-980	1	970-980	1
980-990	1	980-990	1
990-1000	1	990-1000	1
1000-1010	1	1000-1010	1
1010-1020	1	1010-1020	1
1020-1030	1	1020-1030	1
1030-1040	1	1030-1040	1
1040-1050	1	1040-1050	1
1050-1060	1	1050-1060	1
1060-1070	1	1060-1070	1
1070-1080	1	1070-1080	1
1080-1090	1	1080-1090	1
1090-1100	1	1090-1100	1
1100-1110	1	1100-1110	1
1110-1120	1	1110-1120	1
1120-1130	1	1120-1130	1
1130-1140	1	1130-1140	1
1140-1150	1	1140-1150	1
1150-1160	1	1150-1160	1
1160-1170	1	1160-1170	1
1170-1180	1	1170-1180	1
1180-1190	1	1180-1190	1
1190-1200	1	1190-1200	1
1200-1210	1	1200-1210	1
1210-1220	1	1210-1220	1
1220-1230	1	1220-1230	1
1230-1240	1	1230-1240	1
1240-1250	1	1240-1250	1
1250-1260	1	1250-1260	1
1260-1270	1	1260-1270	1
1270-1280	1	1270-1280	1
1280-1290	1	1280-1290	1
1290-1300	1	1290-1300	1
1300-1310	1	1300-1310	1
1310-1320	1	1310-1320	1
1320-1330	1	1320-1330	1
1330-1340	1	1330-1340	1
1340-1350	1	1340-1350	1
1350-1360	1	1350-1360	1
1360-1370	1	1360-1370	1
1370-1380	1	1370-1380	1
1380-1390	1	1380-1390	1
1390-1400	1	1390-1400	1
1400-1410	1	1400-1410	1
1410-1420	1	1410-1420	1
1420-1430	1	1420-1430	1
1430-1440	1	1430-1440	1
1440-1450	1	1440-1450	1
1450-1460	1	1450-1460	1
1460-1470	1	1460-1470	1
1470-1480	1	1470-1480	1
1480-1490	1	1480-1490	1
1490-1500	1	1490-1500	1
1500-1510	1	1500-1510	1
1510-1520	1	1510-1520	1
1520-1530	1	1520-1530	1
1530-1540	1	1530-1540	1
1540-1550	1	1540-1550	1
1550-1560	1	1550-1560	1
1560-1570	1	1560-1570	1
1570-1580	1	1570-1580	1
1580-1590	1	1580-1590	1
1590-1600	1	1590-1600	1
1600-1610	1	1600-1610	1
1610-1620	1	1610-1620	1
1620-1630	1	1620-1630	1
1630-1640	1	1630-1640	1
1640-1650	1	1640-1650	1
1650-1660	1	1650-1660	1
1660-1670	1	1660-1670	1
1670-1680	1	1670-1680	1
1680-1690	1	1680-1690	1
1690-1700	1	1690-1700	1
1700-1710	1	1700-1710	1
1710-1720	1	1710-1720	1
1720-1730	1	1720-1730	1
1730-1740	1	1730-1740	1
1740-1750	1	1740-1750	1
1750-1760	1	1750-1760	1
1760-1770	1	1760-1770	1
1770-1780	1	1770-1780	1
1780-1790	1	1780-1790	1
1790-1800	1	1790-1800	1
1800-1810	1	1800-1810	1
1810-1820	1	1810-1820	1
1820-1830	1	1820-1830	1
1830-1840	1	1830-1840	1
1840-1850	1	1840-1850	1
1850-1860	1	1850-1860	1
1860-1870	1	1860-1870	1
1870-1880	1	1870-1880	1
1880-1890	1	1880-1890	1
1890-1900	1	1890-1900	1
1900-1910	1	1900-1910	1
1910-1920	1	1910-1920	1
1920-1930	1	1920-1930	1
1930-1940	1	1930-1940	1
1940-1950	1	1940-1950	1
1950-1960	1	1950-1960	1
1960-1970	1	1960-1970	1
1970-1980	1	1970-1980	1
1980-1990	1	1980-1990	1
1990-2000	1	1990-2000	1
2000-2010	1	2000-2010	1
2010-2020	1	2010-2020	1
2020-2030	1	2020-2030	1
2030-2040	1	2030-2040	1
2040-2050	1	2040-2050	1
2050-2060	1	2050-2060	1
2060-2070	1	2060-2070	1
2070-2080	1	2070-2080	1
2080-2090	1	2080-2090	1
2090-2100	1	2090-2100	1
2100-2110	1	2100-2110	1
2110-2120	1	2110-2120	1
2120-2130	1	2120-2130	1
2130-2140	1	2130-2140	1
2140-2150	1	2140-2150	1
2150-2160	1	2150-2160	1
2160-2170	1	2160-2170	1
2170-2180	1	2170-2180	1
2180-2190	1	2180-2190	1
2190-2200	1	2190-2200	1
2200-2210	1	2200-2210	1
2210-2220	1	2210-2220	1
2220-2230	1	2220-2230	1
2230-2240	1	2230-2240	1
2240-2250	1	2240-2250	1
2250-2260	1	2250-2260	1
2260-2270	1	2260-2270	1
2270-2280	1	2270-2280	1
2280-2290	1	2280-2290	1
2290-2300	1	2290-2300	1
2300-2310	1	2300-2310	1
2310-2320	1	2310-2320	1
2320-2330	1	2320-2330	1
2330-2340	1	2330-2340	1
2340-2350	1	2340-2350	1
2350-2360	1	2350-2360	1
2360-2370	1	2360-2370	1
2370-2380	1	2370-2380	1
2380-2390	1	2380-2390	1
2390-2400	1	2390-2400	1
2400-2410	1	2400-2410	1
2410-2420	1	2410-2420	1
2420-2430	1	2420-2430	1
2430-2440	1	2430-2440	1
2440-2450	1	2440-2450	1
2450-2460	1	2450-2460	1
2460-2470	1	2460-2470	1
2470-2480	1	2470-2480	1
2480-2490	1	2480-2490	1
2490-2500	1	2490-2500	1
2500-2510	1	2500-2510	1
2510-2520	1	2510-2520	1
2520-2530	1	2520-2530	1
2530-2540	1	2530-2540	1
2540-2550	1	2540-2550	1
2550-2560	1	2550-2560	1
2560-2570	1	2560-2570	1
2570-2580	1	2570-2580	1
2580-2590	1	2580-2590	1
2590-2600	1	2590-2600	1
2600-2610	1	2600-2610	1
2610-2620	1	2610-2620	1
2620-2630	1	2620-2630	1
2630-2640	1	2630-2640	1
2640-2650	1	2640-2650	1
2650-2660	1	2650-2660	1
2660-2670	1	2660-2670	1
2670-2680	1	2670-2680	1
2680-2690	1	2680-2690	1
2690-2700	1	2690-2700	1
2700-2710	1	2700-2710	1
2710-2720	1	2710-2720	1
2720-2730	1	2720-2730	1

Table XVI

Type of Practice	Mean	Standard Error of Mean	Difference	Standard Error of Difference	Ratio
Spaced	93	.36	5.	2.8	1.79
Unspaced	88	2.78			

The standard error of the mean on the tachistoscopic test of three second's duration or less for delayed recall under spaced learning was .36. The chances are two to one that the true mean lies within .36 units of 93, or between 92.64 and 93.36.

The standard error of the mean for the same test but under unspaced learning was 2.78. The chances are two to one that the true mean lies within 2.78 units of 88, or between 85.22 and 90.78.

The difference between the two means 93-88 was 5. To determine its significance the standard error of the difference was computed. This equalled 2.8. The chances are two to one that the true mean difference will lie within 2.8 units from the observed difference 5. In other words, the chances are two to one that similar groups under spaced learning will exceed similar groups under unspaced learning on this test by an amount between 2.2 and 7.8.

The ratio between the difference and its standard error was 1.79. The chances are about 24 to 1 that

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the true difference would not be 1.79_{ϵ_D} units below the observed difference. We are therefore justified in saying that, in so far as the test is valid and the group representative, we are not certain that the skills of word analysis are retained better under spaced learning.

CHAPTER IV
SUMMARY AND CONCLUSIONS

CHAPTER IV

To determine if the skills of word analysis are retained better by spaced or unspaced learning on immediate recall, six words for each phonogram presented, were selected and tested at the end of the five units of practice by a tachistoscopic flash of one-fifth, one-half and three second's duration. The same words tested for immediate recall were retested after a four week interval for retention on delayed recall.

Conclusions

1. The difference 6.35 between the mean scores of the unspaced and spaced learning on the tachistoscopic test of one-fifth second for immediate recall was insignificant statistically. The difference 8. between the mean scores of the unspaced and spaced learning on the test of one-half second duration for immediate recall fell short of statistical significance. The difference 5.36 between the mean scores of the unspaced and spaced learning on the test of three second's duration for immediate recall was statistically insignificant.
2. The difference 9.2 between the mean scores of the unspaced and spaced learning on the tachistoscopic test of one half second for delayed recall was statistically insignificant. The difference 8.8 between the mean scores

of the unspaced and spaced learning was found to be statistically insignificant on the tachistiscopic test of one-half second duration for delayed recall. The difference 5. between the mean scores of the unspaced and spaced learning on the tachistiscopic test of three second's duration fell short of statistical significance.

3. It would appear from this study that statistically skills of word analysis are not retained better by spaced than by unspaced learning on either immediate or delayed recall. However, in spite of no statistical significance being found, the progression of gain shown in the experiment points to significance in itself. More research is needed.

Implications for Classroom Practice.

The achievement under distribution of practice was generally superior to achievement under the massing of practice in this study.

This appears to suggest that the enviromental factor, the rest period, may be utilized so that achievement is increased. The teacher in the classroom may determine the achievement of pupil practice when motivation is held constant by utilizing the rest period. Higher achievement resulting from distributed practice maintains morale and interest on a higher level. High morale, or self motivation, is the greatest force in any learning situation in the classroom. Not only are interests developed from a high morale but effective study habits may be more easily formed and made permanent.

APPENDIX

The following table presents the results of
the Kuhlmann Anderson Intelligence Test:

Case	C.A.	M.A.	I.Q.
1.	7-3	8-1	111
2.	10-3	8	78
3.	10-3	8-6	83
4.	7-10	7-6	96
5.	9-1	8-4	92
6.	7-3	8	110
7.	7-9	8-5	109
8.	10-5	8-7	82
9.	7-8	8-1	105
10.	8-8	8-1	93
11.	7-6	7-7	101
12.	6-6	8	123
13.	7-9	9-8	125
14.	7-8	8	104
15.	7-9	8-4	108
16.	7-8	8-4	109
17.	10-8	8-10	83
18.	8	8-5	105
19.	8-9	8-6	97
20.	8-4	10-2	122
21.	7-7	7-11	104
22.	7-10	8-3	105
23.	7-3	8-1	111
24.	10-7	8-4	79
25.	8-8	8-10	102
26.	8-8	8-7	99
27.	8-2	8-4	102
28.	11-1	9-9	88
29.	8-7	9-3	108
30.	10-2	8-6	84

The following table presents the phonograms of the preliminary test in order of their difficulty as determined by checking the frequency of correct responses to each phonogram among the thirty children.

ome	4	86.67%	uck	8	73.33%	er	28	6.67%
og	4	86.67%	ur	9	70%	as	28	6.67%
age	4	86.67%	eap	9	70%	and	28	6.67%
oach	4	86.67%	ow	9	70%	in	28	6.67%
oast	4	86.67%	ut	9	70%	old	28	6.67%
aid	4	86.67%	op	10	66.67%	am	29	3.33%
om	4	86.67%	eep	10	66.67%	ing	29	3.33%
ait	5	83.33%	ool	10	66.67%	it	29	3.33%
ame	5	83.33%	ell	10	66.67%			
ock	5	83.33%	ank	10	66.67%			
ead	5	83.33%	ouse	10	66.67%			
eak	5	83.33%	or	10	66.67%			
ile	5	83.33%	ilk	10	66.67%			
ure	5	83.33%	ink	10	66.67%			
ot	6	80%	een	10	66.67%			
ue	6	80%	orn	10	66.67%			
onk	6	80%	ix	10	66.67%			
ick	6	80%	ope	11	66.67%			
oot	6	80%	ote	11	66.67%			
atch	7	76.67%	ean	11	66.67%			
oil	7	76.67%	ound	11	66.67%			
aw	7	76.67%	ass	12	60%			
igh	7	76.67%	ite	13	56.57%			
tion	7	76.67%	ake	13	56.57%			
itch	7	76.67%	ook	13	56.67%			
ob	7	76.67%	un	13	56.67%			
alk	7	76.67%	ike	13	56.67%			
oar	7	76.67%	id	13	56.67%			
ig	7	76.67%	our	13	56.67%			
arm	7	76.67%	ine	13	56.67%			
oon	7	76.67%	eet	13	56.67%			
arn	7	76.67%	ap	14	53.33%			
orse	7	76.67%	air	14	53.33%			
ore	7	76.67%	ight	14	53.33%			
unk	7	76.67%	ern	14	53.33%			
oss	7	76.67%	oat	17	43.33%			
ain	8	73.33%	owe	17	43.33%			
eech	8	73.33%	own	17	43.33%			
ape	8	73.33%	end	17	43.33%			
ack	8	73.33%	ay	18	40%			
oom	8	73.33%	up	18	40%			
ill	8	73.33%	all	18	40%			
uch	8	73.33%	eat	20	33.33%			
ood	8	73.33%	out	20	33.33%			
ease	8	73.33%	at	24	20%			
ent	8	73.33%	oy	24	20%			

The following table presents the test words used for immediate and delayed recall under the spaced and unspaced learning.

Spaced Learning		Unspaced Learning	
coast	hog	age	maid
toast	fog	rage	paid
boast	soggy	page	raid
roast	foggy	caged	maiden
roaster	frogs	stage	laid
coasting	bog	bandage	afraid
pile	weak	dock	steady
filed	speak	flock	instead
smile	streak	frock	ready
tiles	leak	stocking	thread
while	sneak	block	spread
stile	creak	pocket	dread
woods	spill	broom	center
stood	pillow	bloom	roomy
hood	still	lent	spent
good	silly	boom	sent
wooden	ill	doom	enter
woody	killing	gloomy	bent
sooner	straw	hobby	nigh
coon	gnaw	sob	sigh
loon	law	robber	fight
balloons	jaw	mob	slight
spoon	crawl	job	bright
moons	cawed	knob	fright
skunk	crossed	stalk	jig
flunk	loss	chalk	twigs
bunker	tossing	balky	wiggle
shrunk	bossy	walker	trigger
spunk	across	talked	digging
punk	moss	chalky	figs
donkeys	bottom	ticket	true
honking	blotter	nickel	slue
conked	rotted	sticky	cue
honks	shot	stricken	dues
conk	slot	pickles	glue
donkey	cotton	bricks	hue

thatch
broiler
toiler
boiling
soiled
foil

spoil
patches
snatching
latched
scratch
matched

hitching
switches
pitcher
ditch
stitched
kitchens

forehead
pore
shore
bore
snored
swore

sprain
grain
fainted
remain
stains
brains

plucky
tucked
buckle
bucket
stuck
chuck

shaped
grapes
caper
scrape
escape
tape

tackle
crackers
tracked
sack
rack
stack

Unit of Practice--No. IV

Spaced Learning

Billy Ross tossed the ball. What a hit! Away it sailed across the field. Bobby ran like the wind to win the game for his side. Billy was cross because it was a loss for his team. Which side would you have joined if you had been there?

Jerry had a lot of fun camping in the woods. Every night he slept in a bunk. Every day he fed hunks of cheese and bread to the chipmunks and squirrels. One day he stepped on a skunk. Whew! He ran so fast his voice sunk to a whisper. Do you think his mother knew what had happened to him?

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Unit of Practice NO.V

Spaced Learning

One day I got lost in the woods. It grew very dark but I was full of spunk. I found some punk with which to start a fire. I had flunked my lesson in fire-making but this time it really started. The skunks and chipmunks watched me. I got some leaves for a bunk and went to sleep. I knew my father would find me. He did, too.

The children went across the crossing into the woods. They started looking for moss. Bobby was the boss and told them how to dig it. Two of the boys did nothing but gossip and they didn't find any. All the rest worked instead of talking. Mother was pleased with them and she liked the moss.

1881-1882

1881-1882

The first of the year was a very dry one, and the crops were much injured. The second of the year was a very wet one, and the crops were much injured. The third of the year was a very dry one, and the crops were much injured. The fourth of the year was a very wet one, and the crops were much injured. The fifth of the year was a very dry one, and the crops were much injured. The sixth of the year was a very wet one, and the crops were much injured. The seventh of the year was a very dry one, and the crops were much injured. The eighth of the year was a very wet one, and the crops were much injured. The ninth of the year was a very dry one, and the crops were much injured. The tenth of the year was a very wet one, and the crops were much injured.

The first of the year was a very dry one, and the crops were much injured. The second of the year was a very wet one, and the crops were much injured. The third of the year was a very dry one, and the crops were much injured. The fourth of the year was a very wet one, and the crops were much injured. The fifth of the year was a very dry one, and the crops were much injured. The sixth of the year was a very wet one, and the crops were much injured. The seventh of the year was a very dry one, and the crops were much injured. The eighth of the year was a very wet one, and the crops were much injured. The ninth of the year was a very dry one, and the crops were much injured. The tenth of the year was a very wet one, and the crops were much injured.

Unit of Practice--No. IV

Unspaced Learning

There was a lesson in Jerry's book about corn. He talked and talked about it. He showed me a picture of the tall stalks. He liked it so much he ~~made~~ one like it with chalk. He even made me in the picture, too. I was walking in the corn. Did you ever walk in a corn field?

I saw a circus parade yesterday. The biggest clown had on a green wig. Every time he danced a jig, the wig fell off! He tried digging in the sand but a pig ran right into him and made the trigger of his gun go off! Bang! Bang! Everyone laughed. I did, too.

Unit of Practice--No. V

Unspaced Learning

My brother Bob has a balky pony. Sometimes the pony won't move at all. Bob is a great talker and he talks to the pony. Sometimes he hits the pony with long stalks of grass. He won't move even then. He runs and gets some carrots he made with orange chalk. What do you suppose the pony does?

Did you ever see a fig tree? The figs I saw grew on twigs high in the air. I climbed that tree because I wanted some figs to eat. I wanted a sprig of leaves to bring home, too. When I started to eat one fig, a little worm wriggled out of it . I was afraid but my brother just giggled at me.

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APPENDIX

1. The first part of the book is devoted to a general survey of the history of the subject.	1. The first part of the book is devoted to a general survey of the history of the subject.
2. The second part is devoted to a detailed study of the various theories of the subject.	2. The second part is devoted to a detailed study of the various theories of the subject.
3. The third part is devoted to a study of the various methods of the subject.	3. The third part is devoted to a study of the various methods of the subject.
4. The fourth part is devoted to a study of the various applications of the subject.	4. The fourth part is devoted to a study of the various applications of the subject.
5. The fifth part is devoted to a study of the various results of the subject.	5. The fifth part is devoted to a study of the various results of the subject.
6. The sixth part is devoted to a study of the various problems of the subject.	6. The sixth part is devoted to a study of the various problems of the subject.
7. The seventh part is devoted to a study of the various questions of the subject.	7. The seventh part is devoted to a study of the various questions of the subject.
8. The eighth part is devoted to a study of the various theories of the subject.	8. The eighth part is devoted to a study of the various theories of the subject.
9. The ninth part is devoted to a study of the various methods of the subject.	9. The ninth part is devoted to a study of the various methods of the subject.
10. The tenth part is devoted to a study of the various applications of the subject.	10. The tenth part is devoted to a study of the various applications of the subject.

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1. The first part of the paper is devoted to a general discussion of the problem. It is shown that the problem is well-posed and that the solution exists and is unique.

1. Introduction

2. The second part of the paper is devoted to a detailed analysis of the problem. It is shown that the problem is well-posed and that the solution exists and is unique.

2. Preliminary results

3. The third part of the paper is devoted to a detailed analysis of the problem. It is shown that the problem is well-posed and that the solution exists and is unique.

3. Main results

4. The fourth part of the paper is devoted to a detailed analysis of the problem. It is shown that the problem is well-posed and that the solution exists and is unique.

4. Conclusions

5. The fifth part of the paper is devoted to a detailed analysis of the problem. It is shown that the problem is well-posed and that the solution exists and is unique.

5. Acknowledgments

6. The sixth part of the paper is devoted to a detailed analysis of the problem. It is shown that the problem is well-posed and that the solution exists and is unique.

6. References

7. The seventh part of the paper is devoted to a detailed analysis of the problem. It is shown that the problem is well-posed and that the solution exists and is unique.

7. Appendix

Starch, D.

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